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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/722,729	11/25/2003	Nicolas Bright	LAM2P318C	7358

25920 7590 12/22/2004

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EXAMINER	
NGUYEN, GEORGE BINH MINH	
ART UNIT	**PAPER NUMBER**
3723	

DATE MAILED: 12/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/722,729	BRIGHT ET AL.	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *112503*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Receipt is acknowledged of the IDS filed on November 25, 2003 which has been considered and placed of record in the file.

Claims 1-12 are presented for examination.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiou et al.'5,873,769.

With reference to Figures 4-5, col. 4, line 48 to col. 5, line 20, Chiou discloses a temperature compensated chemical mechanical polishing to achieve uniform removal rate. Please note that col. 5, lines 30-35, Chiou discloses a thermal gradient between the inner circular segment 61 and the outer circular segment 65. Furthermore, in col. 5, lines 58-67, Chiou inherently teaches a temperature measuring means and a controller to adjust the temperature of the heat transfer system in order to control the wafer temperature.

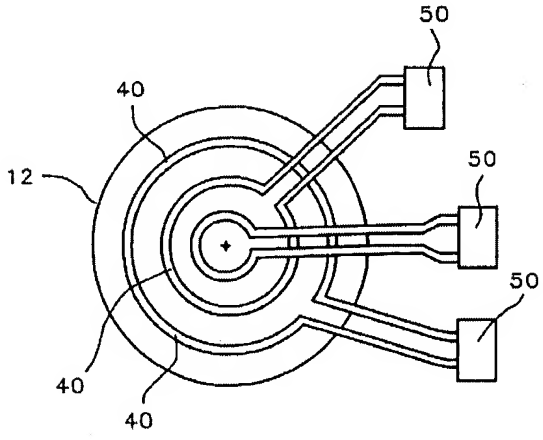


FIG. 5

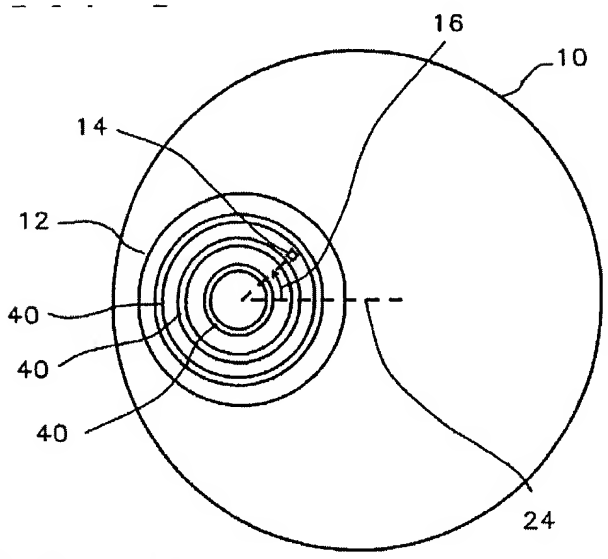


FIG. 4

As shown in FIG. 4 a number of concentric heating elements 40 are placed in the wafer carrier so that the temperature of circular regions of the wafer carrier, concentric with the center of the wafer carrier, can be independently controlled. The temperatures are adjusted so that the temperature at the center of the wafer carrier is the greatest and decreases with increasing distance from the center of the wafer carrier to the edge of the wafer carrier, which is at the lowest temperature. With this temperature variation the same wafer material removal rate, independent of either distance from the center of the wafer or position angle, can be achieved over the entire wafer surface of the wafer as shown by the top curve 74 in FIG. 3.

FIG. 5 shows methods and apparatus of heating the concentric heating elements 40 in greater detail. The concentric heating elements 40 can be electric heating elements in the wafer carrier 12 supplied by independent electrical power sources 50. The concentric heating elements 40 can be tubes in the wafer carrier 12 through which heated or cooled liquid from independent sources 50 flows.

FIG. 6A shows the normalized removal rate of wafer material as a function of position angle for the case where the platen angular velocity is greater than the wafer carrier angular velocity. Curves **80**, **81**, and **82** show the normalized removal rates of material from the wafer as a function of the position angle with no adjustments to the temperature of either the wafer carrier or the platen. The bottom curve **80** shows the normalized removal rate at the center of the wafer. The middle curve **81** shows the normalized removal rate at a distance between the center and the edge of the wafer. The top curve **82** shows the normalized removal rate at the edge of the wafer.

As shown in FIGS. **4** and **5** and described above the temperature of circular segments of the wafer carrier can be adjusted. The temperatures are adjusted so that the temperature at the center of the wafer carrier is the greatest and decreases with increasing distance from the center of the wafer carrier to the edge of the wafer carrier, which is at the lowest temperature. The result of this temperature adjustment is that the removal rates at different distances from the center of the wafer are nearly the same but still show a dependence on position angle, as shown in curves **80**, **81**, and **82** of FIG. **6**B.

FIG. **8** shows a diagram of the platen **10** and the wafer carrier **12** showing circular segments, **61**, **63**, and **65** of the platen and circular segments, **41**, **43**, and **45** of the wafer carrier. It can be seen from FIG. **8** that the temperature of each circular segment of the platen affects the removal rate for a position angle **16** of θ and 360°−θ. Next the temperature of circular segments of the platen, **61**, **63**, and **65** are adjusted so that the temperature of the inner circular segment **61** of the platen corresponding to position angle of 0° or 360° is the highest, the temperature of the outer circular segment **65** of the platen is the lowest, and the temperature of the circular segments progress between these extremes in a regular progression.

The temperature adjustment of the platen circular segments described above superimposed on the temperature adjustment of the wafer carrier circular segments described above produces a removal rate which is nearly constant over the entire surface of the wafer, as shown by curve **84** in FIG. **6**B. The actual variation of the normalized removal rate of material from the wafer is less than about 4% from the highest removal rate to the lowest removal rate.

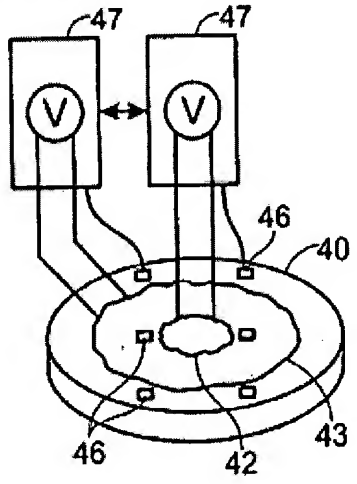
FIG. **7**A shows the normalized removal rate of wafer material as a function of position angle for the case where the platen angular velocity is less than the wafer carrier angular velocity. Curves **90**, **91**, and **92** show the normalized removal rates of material from the wafer as a function of the position angle with no adjustments to the temperature of either the wafer carrier or the platen. The bottom curve **90** shows the normalized removal rate at the center of the wafer. The middle curve **91** shows the normalized removal rate at a distance between the center and the edge of the wafer. The top curve **92** shows the normalized removal rate at the edge of the wafer.

As shown in FIGS. **4** and **5** and described above the temperature of circular segments of the wafer carrier can be adjusted. The temperatures are adjusted so that the temperature at the center of the wafer carrier is the greatest and decreases with increasing distance from the center of the wafer carrier to the edge of the wafer carrier, which is at the lowest temperature. The result of this temperature adjustment is that the removal rates at different distances from the center of the wafer are nearly the same but still show a dependence on position angle, as shown in curves **90**, **91**, and **92** of FIG. **7**B.

However, Chiou does not specifically disclose a thermal energy detector comprising a plurality of separate detectors spaced along a diameter of the wafer as set forth in the claims.

With reference to Figure 3, col. 3, lines 22-49, Monroe discloses a temperature controlled CMP with a mechanism comprising electric coils 42,43 which provide central and outer region heat sources or heat sinks, depending on the direction of current flow. Temperature sensors 46 provide temperature feedback through temperature control circuit 47. The advantage is to regulate the wafer carrier and thereby regulating the temperature of an attached wafer. Please note that temperature sensors 46 are spaced along the diameter of 5 in order to measure each separate spaced location of the thermal energy unit 42,43.

Fig. 3



Referring to FIG. 3, a perspective view of one embodiment of a carrier plate **40** for use in a wafer carrier **20** in accordance with the present invention is shown. Carrier plate **40** includes temperature control mechanisms to achieve a more uniform temperature across the entire surface of the carrier plate. In the embodiment of FIG. 3, carrier plate **40** includes two piezo electric coils **42,43** which provide central and outer region heat sources or heat sinks, depending on the direction of current flow. Temperature sensors **46** provide temperature feedback through temperature control circuit **47**. Control circuit **47** provides current in a first direction to cause a coil to function as a heat source and in an opposite direction to cause a coil to function as a heat sink, as is known. While two coils are shown in FIG. 3, it should be understood that additional coils (and more temperature sensors) could be provided for more precise temperature control.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have provided the Chiou CMP apparatus with a thermal energy detector with a plurality of detectors spaced along a diameter of the wafer and a

feeback controller as taught by Monroe in order to regulate the carrier temperature and therby regulating wafer temperature to achieve a uniform polishing rate.

Regarding to claim 3, feedback control circuit inherently teaches comparing the measured temperature against a set point (desired) to render the actual thermal gradient equal to the desired thermal gradient.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 703-308-0163. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 703-308-2687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE NGUYEN
PRIMARY EXAMINER

George Nguyen
Primary Examiner
Art Unit 3723

GN – December 17, 2004